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NOTES ON THE STRATIGRAPHY AND PALAEONTOLOGY OF TASMANIAN CAMBRIAN, ORDOVICIAN, AND SILURIAN ROCKS

by

A.A. Öpik

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Introduction. At the invitation of Prof. S.W. Carey, the author visited Tasmania during the period 15th November to 2nd December, 1950, to take part in discussions on Cambrian geology in Tasmania and to learn in the field the results of recent investigations on Tasmanian older Palaeozoic rocks. During the visit the author had the opportunity of expressing his opinions both on newly discovered fossils and on the age of some Palaeozoic units, and the main object of this report is to record these opinions.

I wish to express my thanks to Professor Carey for the courteous invitation and to Mr. M.R. Banks and Mr. J.N. Elliston for arrangements and guidance during the field excursions.

Programme

1. A symposium-discussion on the Cambrian and near-Cambrian rocks of Tasmania.

2. Excursion to the Ida Bay Limestone by A. Öpik and M. Banks - 3 days.

3. Excursion to Zeehan - 1 week. Mr. Elliston led the excursion in the Dundas area; Mr. Banks in the Zeehan area.

4. Excursion to the Mt. Tim Shea area and the Florentine Valley, led by Mr. Banks - 3 days.

5. Preliminary examination of collections and discussion of the results at the Geological Department of the University in Hobart - 2 days.

1. The Symposium - Discussion

Professor Carey opened the symposium with an introduction into the problems of Cambrian geology in Tasmania. The second speaker was Mr. J. Bradley, who presented his paper "Summary of the geology of the West Coast Range". Mr. Elliston then spoke on "The stratigraphic succession in the Dundas area", and Miss B. Scott on "Cambrian volcanic rocks in Tasmania". The next speaker was A.A. Öpik with a communication entitled "Relations of the Tasmanian Cambrian to the middle Cambrian of the mainland of Australia". The last paper, "Palaeogeography of the Cambrian in Australia", was presented by Mr. Banks.

Dr. Garretty and Dr. Loftus Hills were among the guests. Summaries of the papers of Mr. Bradley, Mr. Elliston, Mr. Banks, and Miss Scott, are attached to this report.

A. Öpik spoke on the two Middle Cambrian seas in Australia with their two different faunas separated by a near - 130° meridional divide. The eastern fauna is represented in north-western Queensland and at Heathcote, Victoria, and the Tasmanian Cambrian appears to be essentially "eastern", although influenced by an influx of some forms from the Chinese palaeogeographical province.

During the discussions Mr. Bradley's paper was highly praised, especially for his maps and for his treatment of the problems of granitization and the "hematite front".

Mr. Elliston presented many new observations, including practically a new interpretation of the geology of Dundas.

Miss Scott earned much attention for her discussion of the problem of the palagonite (basaltic-glass flows under glacial conditions) in the glacial sequence of King Island.

Discussing A.A. Öpik's lecture, Dr. L. Hills said that the proposed correlation of the Tasmanian Cambrian with the Heathcotian is indeed more acceptable than that with South Australia, which has been popular among Tasmanian geologists.

Mr. Bank's paper, a clear and well-presented picture of the late Pre-Cambrian and Cambrian history of Australia, was the subject of some supplementary informational remarks by A. Öpik.

2. The Ida Bay excursion

The lowest exposed beds of the Ida Bay Limestone contain Tetradium, and may be correlated with the Tetradium Limestone at Queenstown and Zeehan. The middle beds at Ida Bay suggest a correlation with the upper part of the limestones at Zeehan Smelters. The top part of the Ida Bay Limestone, with Upper Ordovician to Lower Silurian corals, is perhaps only partly represented at Zeehan Smelters. The limestone is only gently folded, but seems to be broken off by several faults which obscure the sequence.

The Ida Bay Limestone ranges from the top of the Middle Ordovician into the base of the Silurian.

3. Excursion to Zeehan

A. Cambrian at Dundas. Six fossiliferous localities discovered by Mr. Elliston were examined, and fossils collected. They belong to the upper half of the Middle Cambrian. The highest zone contains the Drepanura fauna of the Chinese Middle Cambrian, with numerous trilobites of which Blackwelderia cf. Biloba Kobayashi (field determination : Drepanura) is the dominant form. Other forms include a Conocephalites (?) or Anomocarella (?) and several agnostids. The age is top of Middle Cambrian, perhaps passage to Upper Cambrian. Only one locality is known, in Barkers Creek between Mt. Razorback and Carbine Hill.

The next lower horizon represents the Hydroid beds, previously recorded by Dr. D. J. Thomas. The trilobites here are agnostids, Solenoparia, and Bathyuriscidae. Most probably it corresponds to the "Dolichometopus Band" of Heathcote.

The third fossil horizon produced the trilobites Lorenzella, Ptychagnostus (?), and Conaspis(?)(or Mandshurella?). The presence of Phychagnostus suggests that this bed may be below the second horizon. The determination of fossils here proposed is preliminary, as the examination is still in progress, but possible changes of names in the future cannot change the range of the total fossiliferous part of the Dundas slates from the upper half of the Middle Cambrian.

B. Ordovician at Zeehan and Queenstown. In the limestone of Zeehan Smelters some fossils previously known and some not hitherto observed were collected. The highest beds there still belong to the Upper Ordovician.

The West Coast Range Conglomerate, according to J. Bradley, is completely conformable with the Upper Ordovician Limestone, and therefore ranges between the base of the Tremadocian and the top of the Middle Ordovician.

C. Eldon Group. According to E.D. Gill and M.R. Banks (1950), the sequence of the Eldon Group is as follows :-

Bell Shale
Florence Quartzite
Keel Quartzite
Amber Slate
Crotty Quartzite
Ordovician Limestone.

In the lower part of the Amber Shale a well-preserved ostracod fauna was collected. The main genus is Gillatia Öpik (manuscript), previously recorded from the Lower Silurian of Victoria ("Illaenus Band", Upper Llandovery), and thus a correlation of the lower part of the Amber Shale with the "Illaenus Band" and generally with the Keilorian seems reasonable. The Crotty Sandstone, lying between the Upper Ordovician and Upper Llandovery, represents Lower and Middle Llandovery (Lower Silurian), which is the range of the "Capital Hill unconformity" in Canberra, perhaps of the Benambran orogeny in Victoria, etc. The change of facies in Tasmania from Ordovician limestone to the sandstone and shales of Crotty is the projection of the contemporary orogeny in Victoria and New South Wales. The Crotty Sandstone, with its interbedded shales, hieroglyphic markings, bands of grits and conglomerates, and slumping, shows indeed the features of a distal orogenic sediment, and is the product of the erosion of the early Silurian mountains of the mainland.

4. Excursion to the Mt. Tim Shea area.

The northern slopes of Tim Shea and the adjacent part of the Florentine Valley represent a complete sequence of the Ordovician from the Lower Trémadoc up to the top of the system. Many new outcrops have been created by the roads of the Newsprint Timber Concession, and the building of them is still in progress.

During the excursion A. Öpik and M. Banks, after collecting fossils and discussing the sequence of the Ordovician in this part of Tasmania, agreed on the following preliminary interpretation of the system (units in ascending order):

(a) The Tim Shea Conglomerate, with interbedded fossiliferous sandstones in the higher parts, which contain gastropods (Lecanospira?) and trilobite fragments, represents the base of the Tremadoc. Obviously the Tim Shea Conglomerate is older than the West Coast Range Conglomerate, and both are separate units of different Ordovician ages.

(b) Above the Tim Shea Conglomerate lie green slates with sandstone beds. The slates contain trilobites, brachiopods, gastropods, and nautiloids, still of a Tremadocian aspect.

(c) In higher horizons the green slates change into calcareous shales, which are deeply leached but still fossiliferous. In places they are impure limestones but leached to the state of a mudstone, with limestone preserved as floaters. The leached parts often show a secondary compaction due to the loss of supporting lime. Large outcrops of limestone are silicified.

Here, in the lower portions, are several bands rich in brachiopids, followed higher by beds with brachiopods and trilobites (Pliomeridae), which fossiliferous zones were also previously unknown.

Above those beds, in a more calcareous facies, are beds containing the complete Caroline Creek fauna, which is most probably that described by A.N. Lewis (1940) as "Junee Series (ii), yellow mudstone containing trilobites". T. Kobayashi (1940a) described the fauna as well as the fossils from Caroline Creek

(Kobayashi, 1940b), without deciding the age-relation between them. The new collections from the calcareous "yellow mudstone" at Tim Shea, besides" the Junee fauna" with Asaphopsis and Tasmanaspis, also contain the Caroline Creek trilobites Tasmanocephalus, Asaphellus, Carolinites, etc. It seems that there is no real age-difference between the Caroline Creek Sandstone and the "Junee yellow mudstone".

(d) Above the Tremadoc and above some silicified and seemingly unfossiliferous limestones, a new fauna of ostracods, brachiopods, and trilobites, occurs, quite different from the Tremadocian. In these beds Mr. Banks found some graptolites also. The age could be well advanced in the Lower Ordovician.

(e) Lying above (d) are partly silicified limestones with poor, indeterminable fossils.

(f) Most probably the next horizon is represented by the calcareous shales with Spanodonta in the Florentine Valley, of a high Middle Ordovician age.

(g) Unit (f) is followed by limestones of a considerable thickness, with cephalopods and ostracods.

(h) Limestone with Rhynidictya, strophomenids, and Upper Ordovician trilobites, at the Benjamin Homestead on the eastern bank of the Florentine River. This member can be correlated with the middle part of the limestone in Smelters Quarry at Zeehan.

(i) Above Unit (h) follow limestones with abundant ostracods, a brachiopod (Zygospira?), and some trilobites. The age is still Upper Ordovician.

The Ordovician record of Tasmania is still incomplete and more fossils must be collected. In some localities this was prevented by lack of outcrops or time or by local silification of the limestone, but Mr. Banks is working on the problem. He is planning a survey of the Gordon River Limestone at the " Big Bend of the Gordon River" in the near future, and the results of this survey are awaited with great interest.

5. Preliminary Examination of Collections.

The field determination of the age of the Cambrian fossils from Dundas has been confirmed, although a comparison with described forms from abroad could not be made because no literature was available. Preliminary lists of fossils were submitted to Mr. Elliston. There will be in the future several changes in the fossil names but not in the age of the beds established as Upper Middle Cambrian. More fossils and new fossil horizons can be expected, as for example in the well-bedded, fine-grained, tuffaceous Cambrian sediments in the vicinity of the Montezuma Falls.

Discussing the problem of the "hematite front" of the West Coast Range with Mr. Bradley, A. Opik suggested that the silification and hematitization of the West Coast Range sediments might be compared with an ancient Ordovician lateritization, subsequently metamorphosed and granitized. If the "hematite front" is of metamorphic origin, the iron most probably migrated by diffusion, but the rate of iron migration under those conditions, despite the high temperature, is low, which means a considerable duration of the granitization itself. The main support for an igneous "hematite front" is seen in the fact that the front cuts the bedding and folding discordantly.

6. Summary of some stratigraphical results.

1. In the Dundas Slates three fossil horizons represent the upper half of the Middle Cambrian.

2. The Tim Shea Conglomerates are of Lower Tremadocian age.

3. The West Coast Range Conglomerate ranges from the top of the Upper Cambrian to the base of the Upper Ordovician, consequently the Tim Shea Conglomerate and the West Coast Conglomerate are two different stratigraphical units. The West Coast Conglomerate is perhaps the younger.

4. The Ordovician sequence at Tim Shea and in the Florentine Valley is continuous, without breaks.

5. The Crotty Sandstone at Zeehan represents the Lower and Middle Llandovery and seems to be a distal orogenic formation.

6. The lower part of the Amber Shale is most probably Upper Llandovery. The rest of the Amber Shale represents the Wenlock, or higher.

7. Diastrophisms:

a. pre-Tremadoc, most probably Upper Cambrian orogeny at Tim Shea;

b. an uplift or orogeny in the Lower Ordovician, as the source of the West Coast Range Conglomerate;

c. no unconformity between the Ordovician and Silurian, but perhaps a disconformity between the Crotty Sandstone and the Upper Ordovician at Zeehan Smelters;

d. violent orogeny in post-Eldon time.

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